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The Cryosphere
Discussions

Interactive comment on "On the influence of model physics on simulations of Arctic and Antarctic sea ice" *by* F. Massonnet et al.

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Communication to the Editor and the Reviewer

Please find below our answer to the anonymous Reviewer #1's comments. We acknowledge your time and careful reading of our manuscript. We have aimed in our answer at providing clear and concise responses. If however there remains some questions regarding the new version of the manuscript, we stay at your disposal for further information.

Sincerely,

On behalf of the authors,

François Massonnet

Answer to Anonymous Reviewer # 1

The Reviewer's comments are in bold font and answers in regular font. The list of references is provided as a supplement to this document

1. **Section 2.1: Which ice parameters were tuned? Just ice albedo, or other parameters as well? As the purpose of the study is to investigate the differences model physics make, it would be good to know which parameters were tuned and how different they are in the LIM2 and LIM3 model. A table with the tuning parameters (if there are several) would be nice to add.**

   We agree on the point that a table would be handful for the reader to summarize the critical parameters used in the study. Therefore, we have added to the original text a table ("Table 1" in the new manuscript). This table includes the four main ice parameters subject to tuning, namely the resistance of ice to compression P^*, the nondimensional atmospheric drag coefficient C_a, the initial thickness of sea ice forming in leads h_0 and the albedo of melting ice α_{melt}.

   The tuning of these parameters is clearly not the subject of the present study. Their values result from the consensus and experience of a wide number of users in the NEMO-LIM community and should be taken as reference values for these models. Now to avoid confusion, we have made the following change in the original manuscript at p. 1172, line 9:

   > *Note that LIM2 and LIM3 ice parameters have been tuned to yield realistic climatologies in each configuration.*

   has been changed to

The full sets of parameters for the LIM2 and LIM3 models result from independent historical tuning procedures with these models (Timmerman et al., 2005; Vancoppenolle et al., 2009). They should be viewed as reference values for each model based on earlier experience. For information, four of them have been reported in Table 1.

2. **Section 2.4: As the main point is to compare the model simulations and the effect of model physics on the simulation, it would have been nice if the models were started from the same initial conditions. I am not asking to redo the simulations, but it would be good to explain here why different initial ice thicknesses are used for the LIM2 and LIM3, and whether these initial conditions still affect the results (one wonders whether they do, as why would one choose different initial conditions otherwise?). This is the most serious comment, and should be addressed before final publication.**

   These small differences in initial thickness of Arctic snow and sea ice in the LIM2 and LIM3 models arise simply because the corresponding namelists (in wich initial thickness is specified) are historically different. However we agree that, for proper comparison, the two simulations should be started from strictly identical initial conditions. Now this has little importance. To clarify our answer, we ran LIM3 with the initial conditions of LIM2 as presented in the original manuscript. As shown in Fig. 1 of the present document (caption is at the bottom of page C4), the differences in sea ice volume between the two LIM3-simulations starting thus with different initial thicknesses of snow and ice reduce by $\sim 96\%$ after 10 years. Again, we stress that the initial sea ice and snow thicknesses mentioned in the paper are not chosen on purpose to be different but are rather inherent to each model's history. Since this has very little effect after ~ 10 years of simulation we did not consider that initial difference as a major problem.

   We made the following change at p. 1173, line 11 of the original manuscript:

   Given the 35 yr of spinup, the slight differences in Arctic initial ice and snow thicknesses have virtually no influence on the sea ice properties during the investigation period.

   has been changed to

   Given the 35 years of spinup, the slight difference in Arctic initial ice and snow thicknesses used as standard values for those two model versions, has virtually no influence on the sea ice properties during the investigation period.

3. **Figure 2: If possible, I would put the NH and SH figures side by side, so that the figure can hopefully be printed bigger, so we can see the details of the wiggles better.**

   Indeed, the detailed variations of the curves are not satisfactorily visible in the online version of the manuscript. However, they are clear in the manuscript prepared with the LaTeX class copernicus.cls (manuscript available at http://www.astr.ucl.ac.be/users/fmasson/paper_physic.pdf). Thus, we recommend that the Editor decides whether these figures should be rearranged or not, depending on his personal appreciation.

Please also note the supplement to this comment:
http://www.the-cryosphere-discuss.net/5/C812/2011/tcd-5-C812-2011-supplement.pdf

Fig. 1. (see Figure below) Difference of Arctic sea ice volume between two experiments with the ocean–sea ice model LIM3. EXP1 (EXP2) has an initial sea ice thickness of 3.5 m (3.0 m) and an initial snow thickness of 0.3 m (0.5 m).

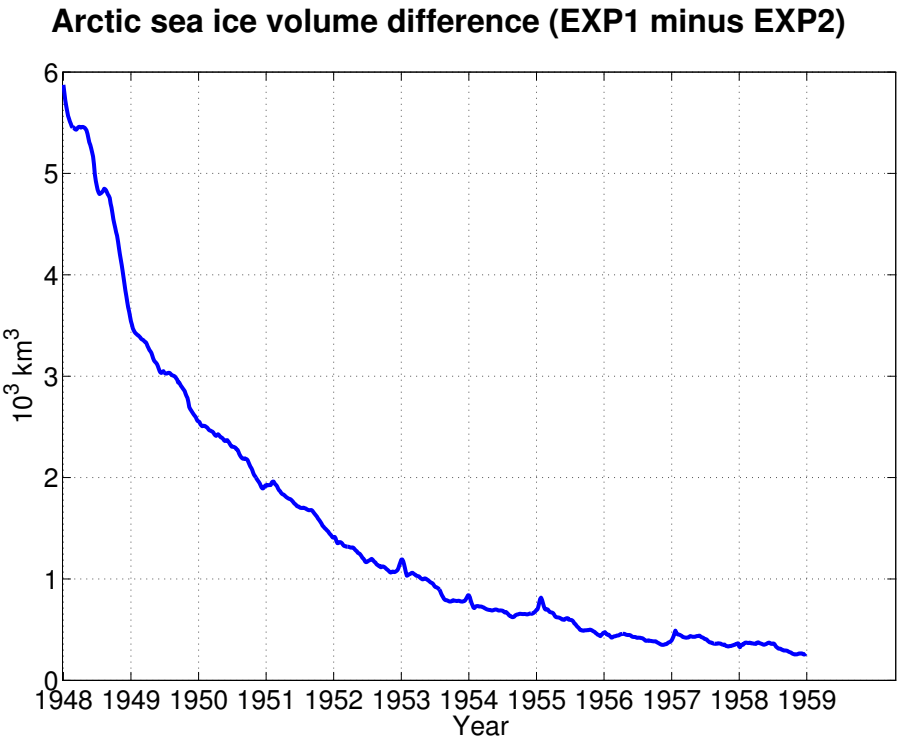
Arctic sea ice volume difference (EXP1 minus EXP2)
6
5
4
3
2
1
0
10^3 km^3
1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959
Year

Fig. 1.